IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Frasch; Wayne D.; et al.	Confirmation No. 4137
Application No.: 10/538534	Art Unit: 1634
Filed: 6/10/2005	Examiner:
Title: Polarization-Enhanced Detector with Gold Nanorods for Detecting Nanoscale Rotational Motion and Method Therefor	SHAW, AMANDA MARIE
Attorney Docket No.: 60227US	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

STATEMENT UNDER 37 C.F.R. § 1.132

Dear Commissioner:

I, Wolfgang Junge, the undersigned hereby declare and state:

1. I am Professor of Biophysics, a copy of my C.V./publication/citation list is attached hereto.

2. I have used closely related methods and understand devices described in the subject application based on my previous expertise and work.

3. Having been among the pioneers of time resolved-polarized photometry[1,2], single molecule detection[3,4] and nanomechanics[5,6] in biology, from 1972 to the present I have conducted research and development in what is commonly known as Biophysics, and, here in particular, structure and dynamics of enzymes and membranes, biological devices and materials that exist and operate in the range of 1 to 1000 nanometers (nm). Many of the methods developed and applied herein have been later extended into modern nanotechnology. It has been said that the ultimate refinement of realization and sensitivity is a single molecule. With nanotechnology, work is done at the molecular

level. Complex processes can take place in such a small space that the application become very portable. Propagation times and energy consumption are negligible.

[1] W. Junge, "Brownian rotation of the cytochrome oxidase in the mitochondrial inner membrane," FEBS Lett. **25**, 109 (1972).

[2] D. Sabbert, S. Engelbrecht, and W. Junge, "Intersubunit rotation in active F-ATPase," Nature **381**, 623 (1996).

[3] O. Pänke, *et al.*, "F-ATPase: specific observation of the rotating c subunit oligomer of EF_oEF_1," FEBS Lett. **472**, 34 (2000).

[4] O. Pänke, *et al.*, "Viscoelastic dynamics of actin filaments coupled to rotary F-ATPase: Torque profile of the enzyme," Biophys. J. **81**(3), 1220 (2001).

[5] D. A. Cherepanov and W. Junge, "Viscoelastic dynamics of actin filaments coupled to rotary F-ATPase: Curvature as an indicator of the torque," Biophys. J. **81**(3), 1234 (2001).

[6] H. Sielaff, *et al.*, "Domain compliance and elastic power transmission in rotary F(O)F(1)-ATPase," Proc. Natl. Acad. Sci. U. S. A **105**(46), 17760 (2008).

4. Nanotechnology finds applications in characterizing and monitoring nanoscopic systems ranging from single molecules to nano-electro-mechanical and nanofluidic systems. Researchers continue to look for new applications of nanotechnology. The concept of realizing independently operating, man-made and engineered devices measured in terms of nanometers has become reality and will continue to progress. And, as the field of biotechnology advances, the need to observe, measure, manipulate, control, and test substances and elements at the molecular level is ever more present.

5. One of the behavioral phenomena that exist in the world of nanotechnology is continuous stochastic motion overlaid to any directed motion. The nature of the motion is directly related to the physical characteristics and environment to which the nanoscale elements and structures are subjected. The ability to detect, observe, measure, and control such motion at the nanometer scale is important to the continuation of research and development of new products and design methods. The development and application of new instrumentation and research techniques for the accurate and reliable detection of motion, particularly rotational motion, in the nanometer range is essential for progress in nanotechnology.

6. Rotary F-ATPase, the essential 'turbo-generator' of the power stations of the cell, has become the test-field for the development of tools for the detection of nanoscale rotation. The laboratory of the undersigned has used polarized photobleaching and depolarization for high time resolution of rotational motion[1]. This technique, applicable to a large ensemble of molecules did not reveal sub-steps of motion in a given single molecule, a limitation that was overcome by a Japanese team[2] who made rotation in a single molecule visible in a fluorescence microscope. Originally they attached muscle fibers of 0.5 to 4 µm length to the rotating shaft of the enzyme, later anisotropically patterned fluorescent polymer microspheres in the range of 2 to 4 µm in diameter and video-graphed their rotation as driven by the central shaft of this enzyme. This approach has been extended to non-fluorescent but light scattering polystyrene spheres. A general drawback has been the diffraction limit of resolution by the light microscope (half the light wavelength in standard design). This limitation has been overcome by focusing the video-evaluation on the centroid of the diffuse diffraction image of the reporter bead/filament. The above techniques, later also used by other laboratories, were greatly successful in characterizing the dynamic and structural properties of this paradigmatic rotary enzyme (see [3] for a recent review).

[1] D. Sabbert, S. Engelbrecht, and W. Junge, "Intersubunit rotation in active F-ATPase," Nature **381**, 623 (1996).

[2] H. Noji, *et al.*, "Direct observation of the rotation of F-ATPase," Nature **386**, 299 (1997).

[3] W. Junge, H. Sielaff, and S. Engelbrecht, "Torque generation and elastic power transmission in the rotary F_OF_1-ATPase," Nature **459**, 364 (2009).

7. The single-molecule fluorescence polarization spectroscopy and the centroid-tracking method share limitations in that the detected signal is weak because fluorescence probes are susceptible to photo-bleaching, and dielectric light scatterers are ineffective. The weak signal-to-noise has been improved by using the more stable quantum dots (nano-scaled semiconductor particles) instead of organic fluorophores. In general, it is difficult to observe rotation of a circular object at any scale when viewed along the axis of rotation unless the rotation of the object is eccentric to the axis of rotation and/or the rotating object has an asymmetric shape. The detection of rotating

molecules with appropriately attached and sufficiently bright probes has been a very time and manpower consuming task lacking the properties for easy and automated processing. The impressive insights on the dynamics of rotary F-ATPase that have been gained by the above techniques have required to handle two obstacles, first finding 'the blurred needle in the haystack' and then studying it over an often too short time interval.

8. The shortcomings detailed in the above two paragraphs, namely (i) limited signal-to-noise, (ii) the necessity to interpret blurred images, and (iii) often too short observation intervals were to a large part overcome by the group of Wayne Frasch. They used gold nanorods. Gold nanorods have the following favourable properties, they are (i) high-intensity light scatterers, (ii) intrinsically of elongated shape, and (iii) they scatter light in two different colors, green and red, depending on whether the short or the long axis of the rod is parallel to the electric vector of the exciting light. The rotation of the rod around an axis perpendicular to its long one is therefore apparent as an alternation of green and red scattered light. Because of small size there is little viscous drag on the rod, and it follows the rotary drive with little delay, thus reporting very fast steps of rotation (microsecond time resolution!). Although this new technique lacks the beauty of video-graphed motion pictures of rotary single molecule as introduced by Noji et al. in 1997 it is superior for automated detection, long-term observation and high time resolution, all of which are properties desirable for nanotechnological applications.

9. It is true that two elements of the present patent application were pioneered by others, the light scattering properties of nanorods were described by Sonnichsen, and the bead-to-F-ATPase construct by Noji, Yasuda et al. Still their combination has not been attempted by the various Japanese groups that have emerged from the laboratories of Masasuke Yoshida and Katsuhiko Kinosita in a project series that has been pushed forward in many different directions, most generously funded by the Japanese authorities. The combination of these two elements is an original contribution by Wayne Frasch. It has led his groups to an unparalleled high resolution of hitherto unresolved substeps (by 36°) in the electromotor-portion of F-ATPase. Most importantly,

the intensity of scattered light, alternating between red and green, was more brilliant and longer lasting than in any previous approach. Therewith automated detection and evaluation and nanotechnical applications beyond the F-ATPase are in close reach.

10. Over the last ten years up to now I have reviewed for top journals the manuscripts of the pertinent groups in Germany, Japan, the UK and the US, and I have met the respective principle investigators at conferences. Till today I am not aware of a duplication of the Frasch-technique by any other group.

11. The superiority and novelty of this new method is evident from the following: (i) The pioneering and still leading big groups in Japan have so far not attempted to resolve the small sub-steps of the electromotor of F-ATPase. (ii) A competing group in Germany, Michael Börsch's, has obtained the first rather limited resolution of these steps by a fluorescence technique (FRET)[1], being hardly convincing to the biochemical community, and (iii) the resolution in Wayne Frasch's method is by far superior[2]. I critically and constructively reviewed the latter two manuscripts for EMBO journal.

[1] M. G. Duser, *et al.*, "36 degrees step size of proton-driven c-ring rotation in FoF1-ATP synthase EMBO J. 28(18), 2689 (2009).

[2] R. Ishmukhametov, *et al.*, "Direct observation of stepped proteolipid ring rotation in E. coli F(o)F(1)-ATP synthase, EMBO J. - in press - (2010)

12. Since at least as early as 2000 there has been a need for a viable detection system to automatically identify and observe over long time intervals single phase molecules that has been unmet until the solution provided by the present invention.

13. Although progress was being made concerning the development of nanoparticles (Mock and Sonnichsen) at the same time as that of single molecule rotation measurements by Noji, Yasuda, Yoshida, and Kinosita, and now also in the hands of Futai in Japan - Börsch, Gräber, Junge in Germany - Montemagno in USA, the dissemination of knowledge between these groups was slow. Each group in this competitive field kept to itself, communication between them was limited, even when sharing a common HFSP grant (e.g between Junge & Yoshida). None of them considered the nanorod rotation. Although all these groups were involved in funding schemes for nanotechnical applications (e.g. of magnetically driven ATP synthesis, F-ATPase based nano-transport devices) none of them considered a high sensitivity application by merging the rotary motor technology (Noji, noted above), nanorod scattering technology (Sonnichsen, Physical Review Letter Pub 112002) and ultra-sensitive DNA detection (Felder, US Patent 6,232,066). The innovative aspect of this application is the successful merger, that has required extensive technical effort beyond that developed by its predecessors.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: November 18th, 2010

Wolfgang Junge

Wolfgang Junge
(Professor of Biophysics)

Curriculum Vitae & Publications:

Born: April, 8th 1940 in Berlin - married, four children

Education

Abitur, Fritz-Karsen-Schule, Berlin-Britz	1959
Industriepraktikum, Siemens & Halske	1959
Student of Physics, Mathematics & Electrical Engineering	
Technische Universität and Freie Universität Berlin	1959 – 1965
Dipl.Ing. (Physics), TU Berlin (H. Boersch)	1965
Dr.ing. (Physical Chemistry), TU-Berlin(H. T. Witt)	1968
Dr.ing. habil. (Physical Chemistry), TU Berlin	1971

Professional Experience

Research Assistant, TU Berlin,	1966-1970
Assistant Professor of Physical Chemistry, TU Berlin,	1971-1973
Visiting Investigator, Johnson Res. Found. Univ. Pennsylvania	1972-73-74
Assoc. Prof. for Physical und Biophysical Chemistry, TU Berlin	1973-1978
Visiting Prof.: Estudos Avancados de Oeiras, Portugal	1973
Visiting Prof. of Biophysics, Univ. of Illinois at Urbana/Champaign	1975
Visiting Prof.: Consejo Superior de Investigaciones Cientificas Madrid	1978
Full-Professor of Biophysics, Universität Osnabrück	1979-2007
Visiting Prof. CEFOBI/Conicet, Rosario, Argentina	1982
Retirement	2007
Niedersachsenprofessor of Biophysics (post-retirement reactivation)	2009-.....

Professional Activities

Max-Volmer-Inst. Physical Chemistry, TU-Berlin	Director	1975-1976
Division of Biophysics, Universität Osnabrück	Head	1979-2007
Department of Biology/Chemistry, Universität Osnabrück	Dean	1984-1985 1996-1997 2005
Senate and Council, Universität Osnabrück	Member	1982-2003
Collaborative Research Unit SFB 171 "Membrane Transport"	Chair	1984-1998
"Membrane Biophysics", German Society for Biophysics	Chair	1984-1985
"Membranes" Gesellschaft für Biologische Chemie,	Board Member	1987-1988
DFG: Senate's Financial Committee for Graduate Colleges	Member	1989-1992
International Society of Photosynthesis Research,	Board Member Secretary President	1989-1992 1992-1995 1995-1999
Volkswagen Foundation,	Trustee	1992-2002
Bioenergetics, German Biopysical Society	Chair	1992-1994
Scientific Advisory Comm., MPI für Bioanorganische Chemie	Member	1995-2005
Scientific Advisory Comm., MPI für Biophysik	Member	1996-2008
	Chair	2002-2008
International Union of Pure and Applied Biophysics (IUPAB)	Council Member	1999-2005
Niedersächsischer Staatspreis	Jury Member	2002-20...
Swedish Science Council, Minerva Foundation,		
CNRS-France, FZ Jülich; Netherl. Sci. Found, DOE etc..	Advisor	
Photobiochem.Photobiophys., Biochim.Biophys.Acta,	Editor. Board	
Europ.Biophys.J., Biospektrum,	"	
Trends in Biochem. Sci.	"	1987-1995

Organization of International Conferences

51. Physikertagung, Berlin, Section Biophysics	1987
Intern. Workshop on Ion Translocating ATPases (with K. Altendorf), Osnabrück	1987
Joint Meeting of the British and German Biophysical Societies (with R. Cherry and H. Hrladky), Cambridge	1988
Ann. Conf. German Society for Biologial Chemistry, Osnabrück (with K. Altendorf and J. Lengeler)	1989
Conference of the German Society for Biophysics, Osnabrück	1992
95th Conf. Deutsche Bunsengesellschaft für Physikalische Chemie, Jena,	1996
2nd Intern. Workshop on ATP Synthase and V-ATP-ase (with K. Altendorf), Osnabrück	1998
11th International Conference of Photosynthesis (with G. Garab), Budapest	1998

Memberships

American Association for the Advancement of Science (AAAS)

American Biophysical Society

American Chemical Society

Deutsche Bunsengesellschaft für Physikalische Chemie

Deutsche Gesellschaft für Biophysik

Deutsche Gesellschaft für Naturforscher und Ärzte

Gesellschaft für Biologische Chemie und Molekularbiologie (GBM)

International Society for Photosynthesis Research (ISPR)

Honors

Röntgen-Preis, Giessen	1970
Niedersächsischer Staatspreis	1997
Peter-Mitchell-Medal	1998
Boris Rajewsky-Preis	1998
Bundesverdienstkreuz I. Klasse	1998
EMBO Member	2000
Very many keynote lectures	1968-2010

Publications (1999-2010)

2009-2010

268. Robert E. Blankenship, David M. Tiede, James Barber, Gary W. Brudvig, Graham Fleming, Maria Ghirardi, M. R. Gunner, Wolfgang Junge, David M. Kramer, Anastasios Melis, Thomas A. Moore, Christopher C. Moser, Daniel G. Nocera, Arthur J. Nozik, Donald R. Ort, William W. Parson, Roger C. Prince, Richard T. Sayre (2010)

Science -submitted-

Comparing the Efficiency of Photosynthesis with Photovoltaic Devices: Recognizing Opportunities for Improvement

267. Dmitriy Shevela, Katrin Beckmann, Jürgen Clausen, Wolfgang Junge, Johannes Messinger (2010)

Proc.Natl.Acad.Sci.USA –submitted-

Photosynthetic oxygen-evolution at elevated oxygen pressure: direct detection by membrane-inlet mass spectrometry

266. André Wächter, Yumin Bi, Stanley D. Dunn, Brian D. Cain, Frank Wintermann, Siegfried Engelbrecht and Wolfgang Junge (2010)

Proc.Natl.Acad.Sci.USA –submitted-

Elastic Power Transmission in Rotary EF_OF_1-ATPase

- The Stiffness of the Peripheral Stalk -

265. C. Weissmann, H.J. Reyher, A. Gauthier, H. Steinhoff, W. Junge, R. Brandt (2009)

Traffic 10, 1655-1668

Microtubule binding and trapping at the tip of neurites regulate tau motion in living neurons

264. W. Junge, H. Sielaff, S. Engelbrecht (2009)

Nature **459**, 364-370

Torque generation by rotary F_oF_1-ATPase

2007-2008

263. H. Sielaff, H. Rennekamp, A. Wächter, H. Xie, F. Hilbers, K. Feldbauer,

S.D. Dunn, W. Junge (2008)

Proc.Natl.Acad.Sci. USA - in press -

Domain Compliance and Elastic Power Transmission in Rotary FOF1-ATPase

262. H. Sielaff, H. Rennekamp, S. Engelbrecht, W. Junge (2008)

Biophysical Journal **95**, 4979-4987

Functional halt positions of rotary FOF1-ATPase correlated with crystal structures

261. J. Clausen, W. Junge (2008)

Photosynthesis Res. 98, 229-233

The inhibitory effects of acidification and augmented oxygen pressure on water oxidation

260. J. Clausen, W. Junge (2008)

Biochim.Biophys.Acta **1777**, 1311-1318

The Terminal Reaction Cascade of Water Oxidation: Proton and Oxygen Release.

259. T. Shutova, H. Kenneweg, J. Buchta, J. Nikitina, V. Terentyev,

S. Chernyshov, B. Andersson, S.I. Allakhverdiev, V.V. Klimov, H. Dau, W. Junge

G. Samuelsson (2008)

EMBO Journal **27**, 782-791

The PSII-associated Cah3 in Chlamydomonas enhances the O_2 evolution rate

by proton removal

258. B.A. Feniouk, A. Rebecchi, D. Giovannini, S. Anefors,

A.Y. Mulkidjanian, W. Junge, P. Turina, B. A. Melandri (2007)

Biochemica Biophysica Acta **1767**, 1319-1330

Met23Lys mutation in subunit gamma of FOF1 synthase from *Rhodobacter capsulatus* impairs the activation of ATP hydrolysis by protonmotive force

257. B.A. Feniouk and W. Junge (2008)

in: The Purple Photosynthetic Bacteria, C. Hunter, F. Daldal, M. Thurnauer and J. Beatty, Eds. pp.475-493, Springer, Berlin.

Proton Translocation and ATP synthesis by F_oF_1-ATPase of Purple Bacteria

256. W. Junge (2007)

in: Primary Processes of Photosynthesis, Principles and Applications, Chapter 21, p. 447-487, G. Renger (Ed)., Royal Society of Chemistry, Cambridge, UK

Photophosphorylation

255. W. Junge & B. Rumberg (2007)

Biospektrum 13, 2-3

Nachruf: Horst Tobias Witt

254. W. Junge, A.W. Rutherford (2007)

Nature **448**, 425

Obituary: Horst Witt (1922-2007)

2005-2006

253. W. Junge, J. Clausen, J.E. Penner-Hahn, C. F. Yocum, H. Dau, M. Haumann (2006)

Science **312**, 470-472

Photosynthetic Oxygen Production

252. J. Clausen, W. Junge (2006)

Photosynth. Res. **84**, 339-345

Search for intermediates of photosynthetic water oxidation

251. . Clausen & W. Junge (2006)

Physik Journal **5**, 18-19

Die Jagd nach dem Gral der Photosynthese

250. J. Clausen, K. Beckmann, W. Junge, J. Messinger (2005)

Plant Physiology **139**, 1444-1450

Evidence that bicarbonate is not the substrate in

photosynthetic oxygen evolution

249. J. Clausen, W. Junge, H. Dau, M. Haumann (2005)

Biochemistry **44**, 12775-79

Photosynthetic Water Oxidation at High O_2-Backpressure Monitored by

Delayed Chlorophyll Fluorescence

248. W. Junge (2005)

Photosynth. Research **87**, 233

On Vik's letter concerning comments on a statement in W. Junge (2004)

247. A. Mulkidjanian, D. Cherepanov, J. Heberle, W. Junge (2005)

Biochemistry-Moscow **70**, 251-256

Proton transfer dynamics at membrane/water interface and mechanism

of biological energy conversion.

246. B.A. Feniouk, W. Junge (2005)

FEBS Lett. **579**, 5114-18

Regulation of the F_0F_1-ATP synthase: the conformation of subunit ε

Might be determined by the direction of subunit γ rotation

245. J. Clausen, W. Junge (2005)

in: *Photosynthesis: Fundamental Aspects to Global Perspectives,*

A. van der Est & D. Bruce , Eds., pp 344-346.

Photosynthetic Water Oxidation Driven Backward

244. W. Junge, N. Nelson (2005)

Science **308**, 642-644

Nature's Rotary Electromotors

243. W. Junge (2005)

BIOspektrum 1/05 – 66-68

Die ATP-Synthase weiter gedreht

2003-2004

242. B. Feniouk, A. Mulkidjanian, W. Junge (2004)

Biochim.Biophys.Acta **1706**, 184-194

Proton slip in the ATP synthase of *Rhodobacter capsulatus*:

induction, properties, and nucleotide dependence

241. M. Müller, K. Gumbiowski, D.A. Cherepanov, S. Winkler, W. Junge,

S. Engelbrecht, O. Pänke (2004)

Eur. J. Biochem. **271**, 3914-3922

Rotary F_1-ATPase. Is the C-terminus of subunit γ fixed or mobile?

240. J. Clausen & W. Junge (2004)

Nature **430**, 480-483

Detection of an intermediate of photosynthetic water oxidation

239. W. Junge (2004)

Photosynthesis Research **80**, 197-221

Protons, Proteins and ATP

238. B. A.Feniouk, M. A.Kozlova, D. A. Knorre, D. A. Cherepanov,

A. Y. Mulkidjanian, and W. Junge (2004)

Biophys.J. **86**, 4094-4109

The proton driven rotor of ATP synthase:

Ohmic Conductance (10 fS), and Absence of Voltage Gating.

237. D.A. Cherepanov,W. Junge & A.Y. Mulkidjanian (2004)

Biophys. J. **86**, 665-680

Proton transfer dynamics at the membrane/water interface:

Dependence on the fixed and mobile pH buffers, on the size and form of membrane particles,

and on the interfacial potential barrier.

236. J. Clausen, R.J. Debus, W. Junge (2004)

Biochim. Biophys. Acta **1655** , 184-194

Time-resolved oxygen production by PSII: chasing chemical intermediates

235. D.A. Cherepanov, B.A. Feniouk, W. Junge, A. Mulkidjanian (2003)

Biophys. J. **85**, 1307-1316

Low dielectric permittivity of water at the membrane interface: Effect on

the energy coupling mechanism in biological membranes

2001-2002

234. W. Junge, M. Haumann, R. Ahlbrink, A. Mulkidjanian, J. Clausen (2002)
Phil.Trans.R.Soc.Lond.B **357**, 1407-1418,

Electrostatics and proton transfer in photosynthetic water oxidation

233. K. Gumbiowski, O. Pänke, W. Junge, S. Engelbrecht (2002)
J.Biol.Chem. **277**, 31287-31290

Rotation of the c subunit oligomer in EF_0EF_1 mutant cD61N.

232. M. Müller, O. Pänke, W. Junge, S. Engelbrecht (2002)
J.Biol.Chem. **277**, 23308-23313

F1-ATPase: The C-terminal end of subunit γ is not required for ATP hydrolysis-driven rotation.

231. S. Klishin, W. Junge, A. Mulkidjanian (2002)
BBA **1553**, 177-182

Flash-induced turnover of the cytochrome *bc*$_1$ complex in chromatophores of *Rhodobacter capsulatus*: binding of Zn^{2+} decelerates likewise the oxidation of cytochrome *b*, the reduction of cytochrome c_1 and the voltage generation

230. B. Feniouk, D. Cherepanov, N. Voskoboinikova, A. Mulkidjanian, W. Junge (2002)

Biophys. J. **82**, 1115-1122

Choromatophore Vesicles of *Rhodobacter capsulatus* Contain on Average One F_0F_1-ATP Synthase Each

228. B. A. Feniouk, D.A. Cherepanov, W. Junge, A. Mulkidjanian (2001)

Biochim.Biophys. Acta 1506, 189-203

Coupling of proton flow to ATP synthesis in Rhodobacter capsulatus: F0F1-ATP synthase is absent from about half of chromatophores

227. J. Clausen, S. Winkler, A.M.A. Hays, M. Hundelt, R. Debus, W. Junge (2001)

Biochim.Biophys. Acta **1506**, 224-235

Photosynthetic water oxidation in *Synechocystis* sp. PCC6903: mutations D1-E189K R and Q are without influence on electron transfer at the donor side of photosystem II

226. K. Gumbiowski, D. Cherepanov, M. Müller, P. Promto, O. Pänke, S. Winkler, W. Junge, S. Engelbrecht (2001)

J. Biol. Chem. **276**, 42287-42292

F-ATPase: forced full rotation of the rotor despite covalent cross-link with the stator

225. W. Junge, O. Pänke, D. Cherepanov, K. Gumbiowski, M. Müller S. Engelbrecht (2001)

FEBS Lett. **25153**, 1-9

Inter-subunit rotation and elastic power transmission in F_0F_1-ATPase

224b. W. Junge, O. Pänke, D. Cherepanov, S. Engelbrecht (2001)

Nova Acta Leopoldina Supplementum Nr. **17**, 19-20

Mechanics of Rotary ATP Synthase

224. Pänke, D. Cherepanov, K. Gumbiowski, S. Engelbrecht, W. Junge (2001)

Biophys. J. 81, 1220-1233

Viscoelastic Dynamics of Actin Filaments Coupled to Rotary F-ATPase: Angular Torque Profile of the Enzyme

223. D. Cherepanov and W. Junge (2001)
Biophys. J. **81**, 1234-1244

Viscoelastic Dynamics of Actin Filaments Coupled to Rotary F-ATPase: Curvature as an Indicator of the Torque222.

222. R. Ahlbrink, B.K. Semin, A.Y. Mulkidjanian, W. Junge (2001)

Biochim.Biophys.Acta **1506**, 117-126

Photosystem II of peas: effects of added divalent cations of Mn, Fe, Mg, and Ca on two kinetic components P^{+}_{680}-reduction in Mn-depleted core particles

1999-2000

221. O. Pänke, K. Gumbiowski, W. Junge, S. Engelbrecht (2000)

FEBS Letters **472**, 34-38

F-ATPase: specific observation of the rotating c subunit oligomer of EF_0EF_1

219. O.A. Gopta, D.A. Cherepanov, W. Junge, A. Mulkidjanian (1999)
Proc. Natl. Acad. Sci. USA **96**, 13159-13164

Proton transfer from the bulk to the bound ubiquinone Q_B of the reaction center in chromatophores of *Rhodobacter sphaeroides*: Retarded conveyance by neutral water

218. B.A. Feniouk, D. Cherepanov, W. Junge, A. Mulkidjanian (1999)

FEBS Lett. **445**, 409-414

ATP-Synthase of Rhodobacter capsulatus: coupling of proton flow through F_0 to reactions in F_1 under the ATP synthesis and slip conditions

217. H. Noji, K. Häsler, W. Junge, K. Kinosita Jr., M. Yoshida, S. Engelbrecht (1999)

Biochem.Biophys.Res.Comm. **260**, 597-599

Rotation of *Escherichia coli* F_1-ATPase

216. K. Häsler, O. Pänke, W. Junge (1999)

Biochemistry **38**, 13759-13765

On the stator of rotary ATP synthase: The binding strength of subunit δ to $(\alpha\beta)_3$ as determined by fluorescence correlation spectroscopy

215. M. Haumann, W. Junge (1999)

Biochim.Biophys.Acta **1411**, 121-133

Evidence for impaired hydrogen-bonding of tyrosine Y_Z in calcium-depleted

Photosystem II

214. W. Junge (1999)

Proc. Natl. Acad. Sci. USA **96**, 4735-4737

ATP synthase and other motor proteins

213. M. Haumann, W. Junge (1999)

Biochim.Biophys.Acta **1411**, 1-6

Photosynthetic water oxidation: A simplex-scheme of its partial reactions

212. W. Junge (1999)
in: *Photosynthese (D.P. Häder, Ed.) ch.7, pp. 132-145, G. Thieme Verlag, Stuttgart*

ATP-Synthese (Photophosphorylierung)

211. M. Haumann, A.Y. Mulkidjanian, W. Junge (1999)

Biochemistry **38**, 1258-1267

Tyrosine-Z in oxygen-evolving photosystem II: A hydrogen-bonded tyrosinate?

210. D.A. Cherepanov, A.Y. Mulkidjanian, W. Junge (1999)

FEBS Lett. 449, 1-6

Transient accumulation of elastic energy in proton translocating ATP synthase

209a. B. Feniouk, D. Cherepanov, W. Junge, A. Mulkidjanian (1999)

FEBS Lett. **445**, 409-414

ATP-synthase of *Rhodobacter capsulatus*: Coupling of proton flow through

F_0 to reactions in F_1 under the ATP synthesis and slip conditions.

Five selected original publications and no. of citations

240. J. Clausen & W. Junge (2004) (71)
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199. R. Ahlbrink, M. Haumann, D. Cherepanov, O. Bögershausen, A. Mulkidjanian, W. Junge (1998) (120)
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181. D. Sabbert, S. Engelbrecht and W. Junge (1996) (396)
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59. W. Junge, W. Ausländer, A.J. McGeer and T. Runge (1979) (134)
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2. W. Junge and H.T. Witt (1968) (351)
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47. + 47a	W. Junge (1977) Ann. Rev. Plant Physiol. **28**, 503-536 Ann. Rev. Reprints: Cell Membranes 1975-1977 Membrane potentials in photosynthesis	(154)
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